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ABSTRACT

Health science (epidemiology) is a relatively advanced discipline which offers theories and methods which could be useful in peace science (polemology). Similarities between war and disease, peace and health, center around concern with prevention of physical damage and death on the one hand and preservation and extension of human life on the other. While the insights and innovations of epidemiological research receive much attention and imply areas of further research, little is known about prediction, explanation, and prescription of peace and war. It appears that once the more integrated and precise methods of epidemiology are applied to polemology, an increase in knowledge about peace and war will likely ensue. The epidemiological model suggests that description should move toward an integrated definition which includes both broad and narrow dimensions. Explanation of peace and war must focus on a system of multiple interrelated causes, including social factors such as technology, biological and physical dimensions, and influences such as the rationality and irrationality of decision makers. Prediction should include prognoses of war and specification of nations at high risk of war. Prescription implies war prevention through global peace maintenance and positive alteration of chronic risk factors. (Author/DB)

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THE EPIDEMIOLOGY OF PEACE AND WAR

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An Epidemiological Perspective on Peace and War

Polemology should follow epidemiology; peace science should model itself on health science.

Polemology is the study of war, peace science the study of peace. (Cf. Bouthoul, 1970; Dedring, 1976; Haavelsrud, 1976; Washburn and Wehr, 1976; Wulf, 1974; Fink and Boulding, 1972; Newcombe and Newcombe, 1972.) Epidemiology is "the study of the distribution and determinants of diseases and injuries in human populations." Its "ultimate concerns" center around prescription for "the prevention of disease and the maintenance of health" (Mausner and Bahn, 1974:313-351).¹

War resembles disease primarily because it has threatened or brought physical damage or death to large populations. Thus the yearbook of world health statistics, published by the World Health Organization, includes "injury resulting from operations of war" in its list of 150 causes of death. War's opposite--peace--is like the opposite of disease--health--in the sense that it implies the preservation and extension of human life.²

¹Mausner and Bahn (1974, 21-22) go on to note that, "it is generally accepted that epidemiologic study can appropriately be applied to all diseases, conditions, and health-related events, including mental illness, suicide, drug addiction, and injury.

A narrower, more strictly medical, definition sees epidemiology as "the branch of medicine that investigates" the incidence of and "all elements contributing to the occurrence of a disease in a population; ecology of a disease." Etiology is the assignment or science of causes or origins of a disease (Webster, 1970. Cf. Suchman, 1968; MacMahon, et. al. 1960).

²The promise of an epidemiology of war rests on the soundness of the analogy between war and disease, peace and health.

Such a comparison is not new. It appears in a number of major analyses. See particularly Alcock, 1972; K. Boulding, 1965, 1962:Ch.7; Richardson, 1960b; Sorokin, 1937:383. See also Singer and Small, 1974; Berkowitz, 1972; Eckstein, 1970; Rosenau, 1964:52; Huntington, 1962:45-46.

Mitscherlich (1969) further broadens the analogy, and reverses it, seeing disease as war, or "sickness as conflict."

The similarity between disease and war suggests that epidemiology is a scientific paradigm which can help integrate and advance theory and research about peace and war. Both epidemiology and polemology have indeed developed along similar lines, moving from magical, mystical ways of thinking to a more scientific outlook, searching for natural and social causes of events in this world rather than the next.

In earlier stages of human history, disease was viewed as a supernatural event, an instrument of Divine wrath or intervention. Often it was dealt with through the rituals of a Shaman, medicine man, witch doctor, or prophet.

Traditional religion saw health and disease at the intersection of the supernatural and natural order, closely tied to Divine manipulation of various aspects of the environment, the virtue and sin of societies and individuals. Thus, the classic Chinese view held that the Emperor assured social well-being so long as he held the Mandate of Heaven. When he lost this Mandate, and his vision of true order failed, the people perished. In the Old Testament, it is reported that the Lord sent a plague upon Egypt at Moses' intercession, because of Pharaoh's transgressions, while granting immunity to the God's chosen people.

In our own times, this perception has not completely disappeared. Large groups of people in so-called primitive and developing societies continue to cling to the beliefs of their ancestors and practice their customs. Advanced industrial society still holds pockets of religious medicine as well. Faith healing, meditation, and prayer are still common human responses to illness.

The traditional view of war, like that of disease, related the supernatural and natural orders. In primitive societies war and magic were closely connected. Wives and relatives of warriors were expected to undertake certain rituals and observe complicated rules. Warriors themselves entered into a semi-divine state. Thus Frazer (1961:12-13, 75, 97) observed that primitive warriors "move, so to say, in an atmosphere of spiritual danger which constrains them to practice a variety of superstitious observances quite different in their nature from those rational precautions which, as a matter of course they adopt against foes of flesh

The appropriateness of this analogy is still a source of considerable controversy. There are important differences between war and disease, primarily because wars are supposed to result from rational human decision rather than forces of nature.

We should note explicitly that we are defining war, not conflict, as a disease. War is a very specific kind of conflict which involves direct obvious injury to life. Conflict in general does not necessarily imply such physical damage. For further discussion of the functions and dysfunctions of conflict see particularly Horowitz, 1971; Coser, 1956; R. L. Kahn and E. Boulding, 1964.

and blood. The general effect of these observances is to place the warrior, both before and after victory, in the same state of seclusion or spiritual quarantine in which, for his own safety, primitive man puts his human gods and other dangerous characters."

The gods were thought to exercise an effect on wars in classical Greece and Rome. Statesmen and military men consulted oracles and soothsayers and undertook prescribed rituals. In the medieval Christian world, prayer was again an important component of military behavior. Religion was a major part of conflicts like the Crusades and the Holy Wars. Even today, Divine providence and judgment remain important dimensions of the perspectives on war of both Western and developing peoples. The need to oppose infidels and godless atheists is still strongly felt in the Islamic, Jewish, and Christian communities. Modern African warfare still incorporates traditional war charms, rites of passage, and sorcery. It involves the spirit of a mystical community. Thus, in a symbolic novel about the Biafran war of secession, the Court of the Here-After hears that, millions of men have died "in the dignity of kinship. . . ." "Yes," said the prosecuting Counsel for Damnation. . . "death is indeed an exercise in pan-Africanism. We have been known to kill each other partly because we belong to each other. We kill each other because we are neighbors" (Mazrui, 1971, cited in Bozeman, 1976:216, 224).

Gradually, however, a more scientific outlook developed and took hold. It came to be called a scientific revolution, but scientific consciousness grew gradually, through evolution. The old supernaturalism continued to exist while the new naturalism took form. Progress was neither continuous nor linear. Breakthroughs occurred and pockets of knowledge appeared in some fields; in others there was relatively little advance (cf. Bronowski, 1973; Kuhn, 1970; Malinowski, 1948).

A new scientific perspective on war, similar to that on disease, emerged. Modern theory and research developed the idea that the causes of war lay, not with the gods, but in the nature of social systems and human beings.

While scientific knowledge of war increased, it grew less quickly than knowledge of disease. Much medical knowledge was based on clinical analysis of a few cases in depth. The same was true for war. Such studies assumed that intensive and painstaking study of a small representative sample of wars provided more general knowledge. Research focused on particular times, geographical spaces, or aspects of war in order to attain greater depth or precision.

Modern statistical techniques added a new dimension. In medicine, aggregate studies of the incidence of such sicknesses as heart disease and cancer showed that individuals who belonged to particular statistical communities were more susceptible to sickness and were more likely to suffer extreme effects. Thus individuals who were overweight, smoked a great deal, were prime candidates. In the field of war, similar studies examined the statistical relationship of various facets of the environment.

Nevertheless, a major difference between the study of disease and war lay in the fact that social scientists could not easily conduct carefully controlled experiments to test their theories. While medical scientists could try out their ideas on mice or monkeys, social scientists had no prospect for conducting large-scale wars of animal species under carefully controlled conditions. Eventually, when medical research established a high likelihood of success, tests on voluntary human subjects could be made; but it would be difficult to think of humans who would volunteer for comparable studies relating to war and peace. Controlled experiments could be conducted on various aspects of conflict between animals and individuals, but such conflict was only distantly related to the violence of whole societies involved in international war. Social scientists, furthermore, had nothing like the microscopic technology which allowed medical science to investigate elements invisible to ordinary human observation.

Another crucial difference between health science and peace science, related to the first, was in the area of professionalization. Modern medicine gradually broke its theocratic ties and became thoroughly secular. Academic degrees were awarded in a variety of fields leading to practice, as well as the general area of public health.³ Peace science has not yet advanced to this point. Although the military claim that "peace is our profession," the primary emphasis of the contemporary peace movement is still religious, its leaders, figures like Gandhi and Martin Luther King. A more comprehensive professional peace profession is still a hope rather than a reality.

Because of the similarity of disease and war, health and peace, and because of the greater progress of epidemiology, it seems reasonable that epidemiology can suggest new insights, implying new questions for further improving description, explanation, prediction, and prescription of peace and war.

Description

Description of peace and war can be improved through more integrated and precise definition, measurement of incidence and casualties, stability and change.

³The League of Nations International Health Yearbook of 1926 (p. 1068) presents a fascinating profile of enrollment and degrees leading to a professional public health career in the United States during 1926. At this time 10 schools had 183 students enrolled and awarded 98 degrees.

Definition

The epidemiological model suggests that description of peace and war should move toward an integrated definition which includes both broad and narrow dimensions.

There has been a good deal of discussion of the merits of narrow and broad definitions of health and disease. A broad definition of health implies the general preservation and extension of human life. Such a definition, based on international consensus, is included in the Constitution of the World Health Organization. "Health," it states, is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (cited in Mausner and Bahn, 1974:6).

From an absolute perspective, if health and disease were mutually exclusive, such a broad conception of health might also imply a very extensive notion of disease. One analyst suggested that, "If health is present only at the zenith--the condition of perfect equilibrium and perfect harmony, which Galen postulated--then it is a final goal, and all that leads up to it is disease." He continued, "if health is the absence of sickness in this very wide sense, we approach. . .the concept of universal sickness--a situation from which statisticians, and no doubt others, including health administrators, instinctively shrink" (Brockington, 1958: 16-17).

At the same time a relativistic approach can take these broad conceptions of health and disease as extremes on a scale.

The difficulty is to determine, as with light and darkness, at which point health and disease meet and whether they are mutually exclusive. If the most perfect functioning of the body is the light of the sun's zenith, and death the 'darkest hour', the point of distinction between health and disease can be anywhere in between. Health may be reckoned as beginning when there is light enough 'to distinguish between a light and a dark thread', or anything less than the zenith may be counted as disease (Brockington, 1958:15).

Within these polar points, narrower definitions of disease assist us in defining more precisely the location of particular maladies. These narrower definitions help describe the absence or presence of identifiable symptoms in the contemporary inventory of disabilities. These definitions permit relatively specific descriptions of the incidence of particular diseases in population groups, death and injury rates related to specific causes and the identification of individual cases of particular sicknesses.

The distinction between peace and war is similar to that between health and disease. There has been considerable debate over the merits of broad and narrow definitions. The broad conception of peace generally covers all levels of social and individual existence and, like the broad idea of health, includes complete physical, mental, and social well-being.

It contains specifications for substantive justice or processes of political order based on previously articulated general laws. Peace may also encompass an affective or emotional component, and even a mystical one--for example, when we talk of eternal peace, or the peace which passeth all understanding, or even peace of mind (see Newcombe and Newcombe, 1972).

An equally broad, and mutually exclusive definition of war or violence would describe any situation which did not meet these criteria. We would then be forced to admit the existence of the universal constant war of all against all described by Thomas Hobbes in the state of nature.

If we take the same relativistic approach to peace and war as we did to health and disease, we can identify them as polar extremes. Narrower definitions can again help us find more specific locations on the continuum.

A much narrower definition of war specifies the presence of direct international violence. By contrast, we can define peace narrowly as the absence of war, or what Galtung (1969:183) has called "negative peace."

This narrower definition includes a political condition, the distinction between international and domestic violence. War is defined to include only violence between states. Violence within states, between groups or individuals, is excluded. For example civil war, revolution, class war, labor war, race war, gang war, range war, street war are all outside our parameters unless they form part of a larger international pattern of violence.

Such a definition also includes a casualty condition. It makes a distinction between direct and indirect violence. We define war to include only direct violence, in which people kill or harm each other immediately. Indirect violence kills slowly and often anonymously. The instruments of indirect violence include poverty, disease, and repression. All lack the specifying characteristic, the actual physical, direct, and brutal act of killing, and so are excluded from the narrow definition.

Measurement

Such definitions are the structural receptacles for measurement and data.

Attempts have been made to construct a summary measure of health, broadly defined. Batteries of statistical measures have attempted to quantify various dimensions of health (Sullivan, 1966). Similarly we might consider fashioning a summary index to measure peace and violence in a very general way. Such an index, like the Dow-Jones average of common stock prices, would be composed of various subordinate dimensions or indicators. It would include statistical measures which would quantify and relate various dimensions of peace and war, including direct and indirect violence at various social levels.

A narrower definition of peace and war would be a component of the broader one. Some good statistics exist concerning the incidence and casualties of wars, at least over the last 150 years. We need to develop these further, in the direction of epidemiological measures of morbidity and mortality.⁴ Such statistics can help provide a firmer foundation for estimating past and present amounts of war, long-range secular trends, and medium and short term patterns of stability and change.

Incidence

Epidemiological morbidity rates are rates of disease, measuring the number of cases of disease relative to given populations or sub-populations. Table 1 presents standard measures of morbidity and adapts them from disease to war.

TABLE 1
MEASURES OF INCIDENCE

<u>Measure</u>	<u>Epidemiology</u>	<u>Polemology</u>
Prevalence Rate	<u>Cases of Disease</u>	<u>Cases of War</u>
	Total Population	Total Population (Nations, Individuals)
	<u>Person-Years of Disease</u>	<u>Nation Months of War</u>
	Total Population	Total Population (Nations)
Incidence Rate		<u>Person-Years of War</u>
		Total Population (Individuals)
	<u>New Cases of Disease</u>	<u>New Cases of War</u>
	Population at Risk	Population at Risk (Nations, Individuals)

The first measure, the Prevalence Rate, divides the number of cases of disease by the total population. Considerable work already exists attempting to provide an inventory of cases of war, at least since the 19th century.

⁴As we shall see, these measures are composed of the same simple numerators and denominators in different arrangements:

cases/or deaths, disabilities, survivors
population, sub-population/or cases

These figures include the number of wars underway as well as percentages of nations involved in wars during different periods (Singer and Small, 1972:Table 7.4). This foundation could be built up further if we expanded the population base to include not only nations but also sub-national population statistics. We should like to know, for example, about war prevalence among nations with different kinds of demographic characteristics. Some work has been done on war incidence related to various indicators of socio-economic status and modernization (e.g., Rummel, 1972). Additional consideration of such vital statistics as levels and rates of increase or decrease in population, sex and age cohorts, birth and death, infant mortality and abortion, population density, urban/rural population, marriage and divorce, immigration and emigration would provide information on whether particular sub-groups appear to be more or less war-prone. Decision-makers would seem a particularly important sub-group to describe in as detailed a way as possible.

The numerator of the epidemiological Prevalence Rate, instead of including the number of cases, may instead describe person-years of disease. A similar measure has been applied to war as well. As we have noted, there is relatively good data on nation-months of war for the last two centuries (Singer and Small, 1972). Measurement of war prevalence could be further expanded by multiplying war incidence by total national populations to get statistics on person-years of war. As in the previous measure, the numerator could then be divided by sub-national population groups.

Another measure of morbidity is the Incidence Rate which divides the number of new cases of a disease by the population at risk. We have comparable historical and contemporary data for numbers of wars begun. It is much more difficult to define the population at high risk of war. In order to do this we would have to have better developed knowledge about the causes of war than presently exists. Nevertheless, sufficient knowledge exists to begin to identify tentative social environmental factors in influencing risk (see pp. 13-22 below). High or low scores on such factors could be used to define high, medium, and low risk populations.

Recent work has suggested the desirability of establishing a Global Monitoring System (Snyder, et. al., 1976). This Global Monitoring System could define the hypothetical major risk factors in terms of key variables and empirical indicators. It might then measure their levels and rates of change and, thereby, arrive at risk estimates for various supra-national communities, regions, nations, and sub-national groups.

Casualties

Epidemiological mortality rates are rates of death, disability, and survival from disease. These can help guide the development of war casualty statistics, to measure death, injury, and survival from wars.

Table 2 presents some common mortality measures and their adaptation to the study of war.

TABLE 2

<u>Measure</u>	<u>CASUALTY MEASURES</u> <u>Epidemiology</u>	<u>Polemology</u>
Case Fatality Rate	<u>Deaths from a Disease</u>	<u>Deaths from War</u>
	Cases of a Disease	Cases of War
	<u>Deaths from a Disease</u>	<u>Deaths from War</u>
	Person-Years of a Disease	Nation Months of War
		<u>Deaths from War</u> Person-Years of War
Proportionate Mortality Rate	<u>Deaths from a Disease in in a period of time</u>	<u>Deaths from War in a period of time</u>
	Total Deaths in a period of time	Total Deaths in a period of time
Case Disability Rate	<u>Disability Days from a Disease</u>	<u>Disability Days from War</u>
	Cases of a Disease	Cases of War
	<u>Disability Days from a Disease</u>	<u>Disability Days from War</u>
	Person-Years of a Disease	Nation Months of War
		<u>Disability Days from War</u> Person-Years of War
Case Survival Rate	<u>Survivors of a Disease</u>	<u>Survivors from War</u>
	Cases of a Disease	Cases of War
	<u>Survivors of a Disease</u>	<u>Survivors from War</u>
	Person-Years of a Disease	Nation Months of War
		<u>Survivors from War</u> Person-Years of War

One of the most elementary mortality statistics is the Case Fatality Rate, which evaluates deaths from a disease as a proportion of cases of a disease or person years of disease. Similar measures already exist in the study of war. Richardson (1960b:Ch. 2) describes deaths in particular wars in logarithmic magnitudes. Singer and Small (1972) calculate battle

deaths per nation month of war. Additional work needs to be done on indirect deaths from war, deaths which do not show up in the battle death statistics. Such deaths might arise among civilian populations as an immediate result of the war experience--from disease or starvation, for example.⁵

The Proportionate Mortality Rate is the number of deaths from a disease in a period of time, divided by total deaths in the same period. This statistic should be easily transferable when we divide the number of war deaths by total deaths.

The Case Disability Rate divides the number of disability days from a disease by the number of cases or person-years of that disease. We might generate a similar war Disability Rate if we could begin to pull together disability data now held by national veterans and welfare programs, as well as private insurance companies.

A more general approach would begin with the definition of "indirect violence" as "avoidable deprivation of life, in lost man-years" (Galtung and Høivik, 1971:73). We might then use quasi-experimental statistical methods on existing life expectancy data to determine significant pre- and post-war life expectancies.

The Case Survival Rate is the converse of the Case Fatality Rate. Instead of death we are concerned with life, survivors of a disease compared with the number of cases or person-years of the disease. Similarly, we may develop a War Survival Rate, in which we measure survivors from a war as a proportion of number of wars, nation-months, or person-years of war.

For all these casualty measures we are interested in the same kind of breakdowns as for incidence, by sub-national populations. These will help us to know more about the characteristics of nations with different casualty levels as well as the characteristics of individuals who become or do not become war casualties themselves.

Stability and Change

An epidemiological perspective can also help delineate patterns of stability and change in peace and war.

The configuration of incidence and casualties help make the distinction between endemic and epidemic disease. Endemic disease has a more stable pattern of morbidity. Prevalence and Incidence Rates all vary within relatively narrow limits. At the same time mortality, as reflected in

⁵The present margin of error is suggested by the fact that estimates of French casualties in Napoleon's armies range between 400,000 and 2,500,000 (Hoedaille, 1972).

Case Fatality, Proportionate Mortality, and Case Disability Rates, tends to be low enough to allow survival and some level of well-being of the host population.

By contrast, epidemic disease shows wide swings in morbidity. Long periods where the disease is hardly in evidence are followed by sudden upsurges in Prevalence and Incidence Rates. At such times mortality may be very high because the host population is under much more sudden attack.

Disease in the modern era generally seems to have moved from epidemic to endemic configuration, as hosts and parasites have come into more constant, regular contact and adapted to each other. Thus McNeill (1976: 226-228) notes a "shift from epidemic to endemic forms of infection," which coincided with and was partially responsible for the modern growth of human population. More regular morbidity has been associated with lower mortality. A major reason for "the decay of the force of epidemics was their increased frequency, until epidemic became merely endemic childhood disease" (McNeill, 1976:343. Cf. Glass and Eversley, 1965).

The distinction between endemic and epidemic configurations may also be useful in describing patterns of stability and change in war and peace. Statistics of war show a pattern which seems to fit the epidemic model fairly well. A relatively low level of warfare seems to exist most of the time. Yet sudden, high, sharp peaks rise from this normal floor (Cf. Singer and Small, 1972:207-209; Tilly, 1973:107).

Contrary to the general trend of disease, war seems to have moved from an endemic to an epidemic configuration. Elsewhere (Beer, 1975), we have noted an apparent long term secular trend toward war concentration and aggravation. The incidence of war seems to have declined; wars appear to have become less frequent and shorter in modern times. At the same time, casualties have become much more severe.

The development of better statistics on war incidence and casualties will help provide a sharper picture of the normal ranges and levels of endemic levels of war and epidemic periods, as well as the direction of long term secular change.

Explanation

Explanation of peace and war should focus on a system of multiple inter-related causes. This includes an environment in which social factors--seen as an integrated technology--play a major role, but in which biological and physical dimensions may also be important. It also allows for rational decision as one among many influences. Alternative comprehensive models should be developed and empirically tested.

The System

Epidemiology includes a system of inter-related causes for disease, a web of multiple causal chains, which link human beings with the multiple factors of their ecology. The network comprehends primary causes of disease, which are known as agents.

When a factor must be present (a sine qua non) for a disease to occur, it is called the agent of that disease. For example, influenza virus is the agent of influenza. Many, but not all, of the known agents of disease are located in the biological environment. Examples of agents from the physical environment are lead, asbestos, beryllium, carbon monoxide in the inspired air, and ionizing radiation. A possible agent in the social environment is maternal deprivation. Numerous studies have demonstrated that the quality of parental care in the early years of life is intimately related to normal physical, emotional, and mental development.

Such agents are not, however, the only cause of disease. "An agent is considered to be a necessary but not sufficient cause of disease because suitable conditions of the host and environment must also be present for disease to develop" (Mausner and Bahn, 1974:27-28. Cf. Susser, 1973; MacMahon, et. al., 1960:Ch. 2).

We may also see the causes of war in the dynamics of a total system of relations. It would be most satisfying if we could isolate a single primary agent, which was a necessary condition for war. Much of the social scientific research on war in the last years has concentrated on relationships between peace, war, and particular variables in the hope of identifying such a primary causal agent.

Unfortunately, a single primary cause of war eludes our grasp. There is not convincing evidence to support any single factor theory. Practitioners in specialized disciplines may try to claim theoretical exclusivity. All such treatments, however, have produced either partial or pseudo-explanations (cf. Mitscherlich, 1971).

Even if we were to identify a primary causal agent for war, it would be unlikely, by itself, to be a sufficient cause for war. We should still wish to know about the contributory effects of other dimensions of the system. We can identify its major components as environment and decision-makers.

The Environment

As it developed, from its mystical origins, the scientific perspective associated disease with different aspects of the environment, "natural causes involving physical, biological, and social factors, that is, causes that can be studied naturally by the human mind," and this consciousness "provided the theoretical underpinning for an epidemiological understanding

of endemic and epidemic disease" (G. Rosen, 1968:164-165). Such factors are also possible contributory causes to war.

Social Environment

The social environment has long been recognized as having an important relationship to health and disease. It was obvious during the classical and medieval periods that certain diseases were contagious and spread quickly and with great damage in human population concentrations. One of the early methods of dealing with such disease was isolation or quarantine. Thus lepers were cast out of society; and victims of the bubonic plague were isolated.

Modern demographic statistics and social theory have made it possible to connect various diseases with such variables as social class, social isolation, and cultural norms. Recent research has also shown a connection between worsening socio-economic conditions and a variety of stress-related illnesses (Brenner, 1973).

The weight of contemporary knowledge suggests that the social environment may not only be an important contributing force, but the most important influence on peace and war. In particular war itself, as a prior cause, and technology appear to be significant elements.

War as a Cause

War is part of the social environment, and contributes to disease as well as to subsequent war itself.

War as a Cause of Disease

War, with its dislocation and damage is one of the social environmental factors which has historically fostered disease. Thus Zinsser (1935:159) reports:

The Thirty Years' War was in all its phases dominated by deadly epidemics. To follow them in detail would be to write the history of this war over again, for the pestilences roamed the Continent in the trains of the armed forces. There is one episode, however, which deserves particular mention, because typhus, single-handed, defeated both armies before they could join battle. In 1632, Gustavus Adolphus and Wallenstein faced each other before Nuremberg, which was the goal of both armies. Typhus and scurvy killed 18,000 soldiers, whereupon both the opposing forces marched away in the hope of escaping further ravages of the pestilence (cf. Concannon, 1967).

McNeill (1976:344) notes that in "the Thirty Years' War, deaths from disease far outstripped deaths from weapons" and this was true for "every European conflict prior to the twentieth century" (See also Cartwright and Biddiss, 1972; Major, 1941).

More recently the global mobilization of World War I helped spread the deadly influenza epidemic of 1918 which supposedly killed over 20 million people--more than the estimated 17 million who were killed or died of wounds inflicted in battle. (See Crosby, 1976; Kay, 1976).

In Europe during the Second World War, infant mortality rose sharply. Among the adult population, civilian resistance was reduced by fatigue, alcoholism, malnutrition, and extreme anxiety.

In France, different afflictions, particularly intestinal ones, became common. . . . On the other hand there was a resurgence of more formidable diseases. Tuberculosis which caused 221 deaths per 100,000 inhabitants in 1907, and only 143 in 1938, regained ground; the toll mounted to 154 in 1942. Moreover the number of deaths attributable to typhoid, which had been 500-870 per year before World War I, but had risen to 1052 in 1932, increased again; 1500 in 1942, or 4 for every 100,000 inhabitants, instead of 3 in 1936. Diphtheria evolved in analogous fashion; the number of syphilis cases almost doubled between 1938 and 1942 (Reinhard and Armengaud, 1961:495-496; cf. Cattell and Gorsuch, 1965).⁶

War as a Cause of War

The social disruption and destruction of war may also contribute to the further spread of war itself. Such a hypothesis is inherent in the idea of war epidemics and contagion, as Richardson (1960a:232-236, 285-286), suggested in a very explicit analogy comparing the ontogeny of disease and war. "Some people are naturally immune" to war, he believed. On the other hand, those who are not immune may undergo "something in war analogous to the rise of temperature in fever." War contagion comes next. "Fighting is infectious," Richardson believed. "The infection is borne by sights and sounds, by rumor, by newspapers, by cinema shows, and by radio." The process finally came around full circle again to resistance and immunity.

A long and severe bout of fighting confers immunity to most of those who have experienced it; so that they no longer readily join in fights. . . . this acquired immunity is not permanent but fades out after a decade or two. Also there arises a new generation, not rendered immune by experience.

A central part of the analogy is the idea that war is contagious. As we have already observed, if one considers violence like a sickness, it is logical that it may be spread across populations which come into contact with the original carrier. Once violence breaks out it should spread exponentially, according to a logistic curve, through the

⁶Other diseases which may be particularly augmented by war include cholera, gonorrhea, hepatitis, meningitis, and smallpox.

susceptible part of the population (Russett, 1976). There should be a positive association of violent incidents and casualties with subsequent violent incidents and casualties--the more violence, the more violence--at least up to a certain point. There is considerable empirical reason to believe that such bunching and acceleration of violence exist to some extent. It is difficult to know the degree to which such departures from normal patterns of behavior are statistically significant; nevertheless, they have taken place in numerous historical spaces and times.

The sudden development of World Wars I and II appear to validate in a particularly striking way the theory of contagion. Both World Wars involved a very rapid movement from peace to war. The number of participants increased as the wars spread across continents and oceans. The scope of violence, reflected in the employment of available military forces and weapons, and casualties, also accelerated very rapidly. Comparative statistics also support the contagiousness of war. Thus the extent of exposure to the possibility of war, measured by the number of borders with other nations, particularly colonial borders or borders with other warring nations, appears positively related to war experience (cf. Garnham, 1976; Starr and Most, 1976; Midlarsky, 1975:68-71; Richardson, 1960b:Ch. 11).

War is, however, only contagious within limits. Not only is there war contagion, but also war resistance. Violence is not contagious in all circumstances. Nor does it spread infinitely or even to the finite natural limits of population or geography.

Resistance is one explanation for the failure of wars to expand farther than most of them have and, after a time, for the eventual drawing down of military effort. Prior experience with violence may help determine which part of the population is susceptible and which is resistant. Such experience brings a realization of the terrible cost of violence, which produces resistance, or "war weariness," which works against the continuing escalation of international conflict (cf. Richardson, 1960a:234-261; Blainey, 1973:6-7). The same weariness presumably applies to domestic violence as well. With the passage of time the costs are made up or forgotten. "War readiness" increases. Violence again breaks out.

This explanation might also help account for the long run pairing of war concentration and aggravation. As the costs of war, measured in casualties, become more serious, people undertake violence less frequently and, when they do, for shorter periods of time. Yet because of the length of time since prior wars, successive ones are more serious.

Statistics on war incidence and casualties show that war increases in bursts but it declines suddenly as well. While past war seems to breed future war in some situations, in others it does not. "One of the more widely accepted propositions in the folklore of international politics is that war begets war, on the premise that: (a) the victorious initiator of war will seek to repeat his success; (b) that another will be encouraged by the example; or (c) that the defeated party will, alone or with others, move as soon as feasible to settle old scores" (Singer and Small, 1974: 274). Nevertheless, evidence of wars between 1816-1965 shows that though

war years tended to follow war years during the 19th century, they did not do so for the total period, or in the 20th century. "Very few nations initiate(d) wars in the decades following prior war experience," though, if they were victorious in such wars, the chances increased somewhat that they would go to war again (Singer and Small, 1974).

The Viet-nam war provides another example: a steep rise through 1968-1969 in absolute levels of American forces committed and killed, munitions and herbicides expended--and then a rapid fall. Total combat casualties rose dramatically between 1963 and the end of 1964, at which point the rate of increase became much more modest. U. S. combat casualties rose sharply through September 1965. At that point they also moderated (Alcock and Lowe, 1969:96-98. Cf. Horvath, 1968; Voevodsky, 1972, 1968:56-63).⁷

Prior violence may influence the probability and seriousness of subsequent violence. By itself, however, it is not a condition which seems either necessary nor sufficient to explain war.

To explain war more fully we need to introduce additional variables which seem to help cause both international and domestic violence. This is the gist of the suggestion that "war and revolution in the concrete are always the result of the concomitance of several conditions, always the same, but appearing in different forms and in a variety of sequences (Timasheff, 1965:283).

We believe that such variables are located in the human technology of our social environment.

Technology as a Cause

War is just a part--and perhaps not a very large one--of the social environment. If we wish to take a broad view of the social environment, we may emphasize technology as an integrating concept. The social environment

⁷ Domestic violence is ambivalent as well in its relationship to war. A constant or regular connection between violence at different levels does not always and necessarily exist. For example, Sorokin (1937) tried to relate the two kinds of violence in European history for the last 2500 years as we have noted. The data for some periods support the assumption of contagion. On the other hand, the data are consistent with the resistance hypothesis in Europe as a whole between the beginning of the 13th and the end of the 16th centuries; in the Roman Empire during the 1st century B.C., the 2nd, 3rd centuries, A.D.; in Rome during the 4th, 2nd, centuries B.C.; and in Greece during the 4th century B.C. (cf. Stohl, 1976, 1975; Wilkenfeld, 1975, 1973a,b, 1972; Blainey, 1973:71; Collins, 1973:274; Tilly, 1973:107; Rummel and Tanter, 1972; Tanter, 1969, 1966; Bwy, 1971:117; Lunden, 1967:Ch. 7; Denton and Phillips, 1967:32; Cattell, 1949).

is that part of the environment related to human beings. To the extent that human beings have shaped their environment, it is an artificial technology, the application and objectification of the scientific revolution.

The modern world environment, in this light, is an immense machine--a world machine. Each of us, whether we struggle against it or not, is a part (cf. Ruggie and Haas, 1975; Ferkiss, 1974, 1969; Mumford, 1967-70; Ellul, 1967; Marcuse, 1964).

When we think of technology we are likely to have in mind applied science, the products of scientific research brought to bear, practically, on human needs. Or we may think of material implements, machines, or automation. But technology is much broader than crude material tools. Man's conquest of nature--man's technology--has developed to such a point that by far the largest part of his environment is artificial. He comes less and less into contact with primal natural environment and more and more interacts with surroundings of his own making. The nature that he does interact with usually has some element of human participation. Thus he seeds clouds, oceans, forests, and lawns to conform to his will.

In its widest sense, technology is "the system by which society provides its members with those things needed or desired" (Webster, 1970). It includes

the distinctive practices that have been generated by the rise of industrialism. These include large-scale organization throughout our society, professionalism in all activities, and the ways of thinking and doing indicated by such typically modern terms as "system," "systematic" methods, and "methodology." Modern technology may be broadly defined as the elaborate development of standardized, efficient means to practical ends. A comparable definition is Kenneth Galbraith's, "the systematic application of scientific or other organized knowledge to practical tasks." Jacques Ellul prefers to call all this simply "technique" (Müller, 1970:3).

Technology incorporates international and domestic levels of organization, the arrangement of relations between and within nations. In the political sector, massive international and domestic bureaucracies, structures of formal organization have appeared. Socio-economically, complex mechanisms for the exchange of goods and services, constraints and incentives, have come into being. Finally, in psycho-cultural behavior, modern language has helped bind together values and ideas.⁸

The effects of technology are not easy to perceive because they are ambivalent. They cut in several directions at the same time. Humanity is unable to refine or control technology completely. Technology performs

⁸Cf. Etzioni (1965), who considers three major dimensions of human action as coercive, utilitarian, and identitive.

important functions in modern society; it also carries with it particular dysfunctions as well. Collective goods imply collective bads.⁹

In many ways this technology, this new environment, is an improvement upon nature. It brings us new comforts, what we like to call a higher standard of living. In other ways, technology is much worse than nature. It brings depletion, pollution, and above all a profound sense of unreality and loss. To pass through a busy city at noon is to be in a different world from the ocean at midnight or mountains at dawn.

If we wish to take a religious or evolutionary tack, we may well call the positive, constructive dynamic technogenesis. It is the technological act of creation, providing new beginnings for humanity. The negative, destructive tendency is technoschismosis, casting humanity out of nature's Eden and setting brother against brother (cf. Richardson, 1960a:65-66; Bateson, 1936).

Technology as a Cause of Disease

We can see such ambivalence in the technology of modern medicine. In peaceful circumstances, international and national bureaucracy work both to reduce and to aggravate disease. The World Health Organization or the United States Food and Drug Administration dispense the life-preserving knowledge of modern medicine. Yet modern medical bureaucracy makes mistakes that balance the equation. It may certify remedies prematurely, as in the case of the Salk vaccine for polio, or erroneously, as with thalidomide which produced congenital birth defects, or the swine flue vaccine which led to Guillain-Barré syndrome. It may play down side effects not yet fully confirmed but potentially harmful, as in the case of X-rays or some birth control techniques (cf. Illich, 1976). Exchange has contradictory effects. On the one hand, it produces and transports medical supplies; on the other hand, it implies the transportation of infectious agents through susceptible populations. Further, some diseases like cancer and heart disease seem more prevalent in industrially advanced economies, with high levels of pollution. Socio-economic conditions in such systems involve high levels of stress from competition, mobility and isolation which in turn contribute to a variety of illnesses.

⁹Cf. Hirschman (1970); Olson (1971).

Marxist theory recognizes this ambivalence in its emphasis on the dialectical interplay of contradictions within advanced capitalist society, which is a mixture of conspiratorial intentions and unanticipated consequences.

Even without a Marxist perspective, however, it is clear that modern technology provides both benefits and costs. Gideon Sjöberg's (1960) dialectical counter-system approach has been particularly valuable for broadening and clarifying my consciousness of this ambivalence. See also Müller, 1970; Wilhelmsen and Bret, 1970.

The values and techniques of correct hygiene are transmitted through language. Yet language can also spread sickness through erroneous health care information, including diets; neurotic attitudes from improper socialization leading to neurotic personality and disruptive effects of panic during epidemics. Receptivity or resistance to learning may come in part from traditional customs, cultural emphasis to innovation, family background, social class, personality, or other factors which affect motivation. Finally, the militarization of medical science could contribute to "the aim of maintaining and augmenting a population that could be economically productive and provide fighting men" (G. Rosen, 1968:166). Or, it may contribute to some of the more inhuman aspects of modern warfare, like certain doctors in the concentration camps of Hitler's Germany (cf. Mitscherlich, 1949) or biochemical weapons.

Technology as a Cause of War

Technology also has ambivalent effects on peace and war. In some ways human technology has served to prevent and reduce warfare. In other ways it has helped to encourage and augment it.

We shall present here in only the briefest outline a simple model which seeks to relate major factors in the social environment, defined in terms of technology, to peace and war. This model is justified at greater length elsewhere (Beer, 1976). Obviously this is only one of many possibilities. Alternative models, which attempt to encompass the whole social environment, need to be further elaborated and tested in an ongoing program of cumulative empirical research.

Figure 1 sketches a simple recursive model, which defines the relationship of three major factors: aggregation, polarization, and militarization. Table 3 defines these factors in more specific terms.

TABLE 3

EXPLAINING WAR: MAJOR FACTORS OF TECHNOLOGY

<u>Aggregation</u>	<u>Polarization</u>	<u>Militarization</u>
<u>Bureaucracy</u>		
International Law	Legal Blocs	Law of War
International Organization	Organizational Coalitions	Alliances
Domestic Government	Centralization	Repression
<u>Exchange</u>		
International Transactions	Super-Groups, Common Markets, Nation-States	Military Trade and Aid
Domestic Markets	Development Discontinuities	Military Complexes Armaments
<u>Language</u>		
International Communication	Exclusivist Ideologies	Hostility
Domestic Communities	Identification	Militance

FIGURE 1

EXPLAINING WAR: THE DYNAMIC OF TECHNOLOGY



NOTE:

The structural equations for this model take the general form

$$W = a + bA + cP + dM + e_1$$

$$M = f + A + hP + e_2$$

$$P = j + kA + e_3$$

$$A = 1 + mW + e_4$$

A = Aggregation, P = Polarization, M = Militarization, W = War

a, f, j, l = constants

b, c, d, h, j, k = variable coefficients without positive or negative signs

$e_1, \dots, e_4$ = exogenous forces

1. Aggregation

Aggregation is a translation of technogenesis, the logic of technology which makes larger relatively integrated units out of smaller elements. It helps produce order, structure, symmetry, regulation and the incremental growth of the world system.

We define technological aggregation in terms of modern superordinate structures and processes of modern bureaucracy, exchange, and language. These include such elements as international law, organization, transaction, and communication; national and sub-national governments, markets, and cultures.

At one point in time, war probably helps generate aggregation. The risks and horrors of war engender construction of collective machinery to prevent and limit it.

To some extent aggregation works. Aggregation at one level tends to limit or reduce violence and militarization at lower ones. Aggregation allows men better to coordinate their activities and ideas, to work peacefully together in larger groups. Aggregation increases the machinery available for cooperation and for limiting conflict. It contributes to the preservation or enhancement of life during peacetime situations, and the protection of large populations during difficult and even catastrophic conditions, including war itself.

There is another aspect of the machinery, however, which is at cross-purposes with the first intent. Aggregation also involves polarization, which works to create and increase violence and militarization.

2. Polarization

Polarization carries part of the dynamic of technoschismosis.

Polarization refers to differentiation of subordinate structures and processes. These include, for example, international legal blocs, organizational coalitions, and trade groups; national and sub-national central governments, socio-economic concentrations; and exclusivist ideologies.

Polarization cordons off parts of the world system from each other. The building blocks of world technology become stumbling blocks for humanity. Sub-group divisions imply conflictual interaction between large masses of people. Sub-group competition and tension enhance insecurity and frustration which in turn make more likely the outbreak of wars (cf. Choucri and North, 1975; M. Haas, 1970; Deutsch and Singer, 1964).

Once war has broken out it is not easily limited. The larger the sub-group, the more serious the damage is likely to be as war sweeps through the sub-group population.

3. Militarization

Such polarization is particularly dangerous when it is tied to militarization; international legal justification for war, alliances, military trade and aid, and militance; domestic dominance of military elites in government, economy, society, and culture.

The very existence of such militarized structures and processes obviously involves the possibility that they will be put to warlike use; and, the more militarized the sub-groups, the higher the level of damage seems likely to be.

When war occurs, it provides an incentive for further aggregation to help prevent it for the next round.

Biological Environment

The biological dimension of the environment has traditionally been important in explaining disease. Biological factors have not usually been adduced as significant causes of war. There is considerable hostility to the idea that the biological environment has any influence at all. Philosophically it seems further to undermine human dignity and freedom of choice. "Human history becomes a mere dimension of natural history" (Thomas, 1976:3).

Nevertheless, there is some reason to believe that further research would be appropriate. While there is little empirical evidence in support of the hypothesis that biological factors, with the possible exception of human nature, are a major contributory factor to peace and war, there is an equal scarcity of evidence for rejecting it.

Biological Causes of Disease

In the traditional view of health science, the most important part of biological environment was the host, the person contracting the disease. The symptoms of disease indicated more fundamental malfunctions in the body. We find this emphasis continuing today in genetics, immunology, geriatrics, and homeopathic medicine (cf. Coulter, 1973-1977).

The development of modern allopathic medicine laid increasing emphasis on biological influences external to the diseased organism, outside agents of disease which were necessary, though not necessarily sufficient, causes of illness. Many of these are found in the biological environment.

Early human experience included experience with predatory macro-parasites, for example, carnivorous jungle animals; but up until a few centuries ago, disease causing micro-parasites were invisible to the naked eye. The first person known to have seen the micro-parasites which live on man was Antony von Leeuwenhoek, a Dutch draper, who lived in Delft during the 17th and 18th centuries. Later pioneers, for example Jenner, Pasteur, and Koch, laid further foundations for the development of microbiology. (See Rosebury, 1969:Ch. 2). Modern epidemiology has charted the various elements of microbiological life cycles, charting reservoirs and vectors of movement, conditions of growth and transmission.¹⁰

Biological Causes of War

In war, the same biological species is both host and agent, attacker and attacked. Human beings--individuals and groups--are macro-parasites, predators upon each other (cf. McNeill, 1976:53).¹¹

Human Nature as a Cause of War

Why do human beings prey upon each other? A recurrent answer has been simply that it is simply their nature, or a part of it. This has been expressed in different metaphors. "Homo homini lupus," man is a wolf to

¹⁰ Population and community ecology studies dealing with mixed species explain such cycles as a result of the interaction between reproduction rate, competition, and carrying capacity (Force, 1974:624-632). Zinsser points out that it may be equally reasonable to view typhus as a disease of the louse or as a disease of man.

Man is too prone to look upon all nature through egocentric eyes. To the louse, we are the dreaded emissaries of death. He leads a relatively harmless life--the results of centuries of adaptation; then, out of the blue, an epidemic occurs; his host sickens and the only world he has ever known becomes pestilential and deadly; and if, as a result of circumstances not under his control, his stricken body is transferred to another host, whom he, in turn, infects, he does so without guile, from the uncontrollable need for nourishment, with death already in his own entrails. If only for his fellowship with us in suffering he should command a degree of sympathetic consideration (quoted in Mausner and Bahn, 1974:27).

¹¹ If we were to combine an organic analogy with the food chain, we might say that human groups feed off individuals, who in turn live from animals and plants. Defense forces seem like macro-anti-bodies to repel foreign invaders.

man, said Hobbes. Freud referred to human destructive instincts as the forces of Kratos or Thanatos.

A broader view links intra-human violence to more general natural tendencies. We find this in the Social Darwinism of Herbert Spencer, emphasizing the survival of the fittest, or in the territorial instinct identified by modern ethology. This territoriality, in turn, is linked to collective fighting behavior in ants, rats, frogs, and numerous other species (cf. Wilson, 1975:50-51, Ch. 11; Schneirla, 1971; Ardrey, 1970; Lorenz, 1966).

Unfortunately, however, general human nature does not help explain why some people are consistently peaceful (cf. Melko, 1973) and others have a relatively high level of belligerency. It seems reasonable that particular genetic endowment plays an important role in setting the scope and limits of such differential behavior. Nevertheless, even genetics only goes part of the way in explaining why the same people are peaceful and violent at different times.

Disease as a Cause of War

We know relatively little about the influence of the external biological environment on war, certainly too little to suggest that viral or bacterial infections are direct primary causes of collective violent behavior. Social science still contains no analogies to microbiology or to providing molecular or sub-molecular explanations. The eminent Richardson (1960a:232) was enticed, but even he feared to draw too close to the possible link. "You will not, I hope, suggest me of being so crazy," he says "as to suggest that war is due to bacteria or to a filterable virus, when I put down for discussion the thesis that fighting resembles measles, influenza, or typhoid fever."

There are, nevertheless, connections between war and the biological environment. As we have already noted, war may help cause certain diseases--influenza, diphtheria, plague, tuberculosis, typhoid, syphilis, for example.

Conversely, disease may also be a natural factor which contributes to war and other violence. Societies with high rates of certain diseases may be particularly vulnerable to external attack. In primitive societies and early extended polities, McNeill (1976:172:45) notes that

lassitude and chronic malaise. . . of the kind induced by blood fluke and similar parasitic infections, conduces to successful invasion by the only kind of large-bodied predators human beings have to fear: their own kind, armed and organized for war and conquest.

Disease may also augment aggressive tendencies. Some forms of mental strain, neurosis, and psychosis are associated with high levels of aggressive behavior (cf. Häfner and Böker, 1972). These, in turn, may have a foundation in some physiological malady, perhaps a slow virus, which allows

the victim to continue functioning, but in a condition which gradually deviates from the norm to a greater and greater degree. For example, neurosyphilis may produce "paranoid cruelty" concomitant with the disintegration of the central nervous system. Caesar, Charlemagne, Mussolini, Hitler and perhaps Winston Churchill may have been so affected (Rosebury, 1971:Ch. 13. Cf. Waite, 1977; Cartwright and Biddiss, 1972). More recently the hypomanic brutality of Ugandan leader Idi Amin has been diagnosed as having a syphilitic base (Legum, 1977).

Disease may also have indirect effects on peace and war. For example, high or unusual levels of disease may help produce increased social stress, which in turn may be a force for violence. Thus McNeill (1976) notes that, in Northern European societies

the absence of well-defined public quarantine regulations and administrative routines--religious as well as medical--with which to deal with plague and rumors of plague, gave scope for violent expression of popular hates and fears provoked by the disease. In particular, long-standing grievances of poor against rich often boiled to the surface. Local riots and plundering of private houses sometimes put the social fabric to a severe test (Cf. Davis, 1973).

Biological factors may, in the end, explain little of the variance in peace and war. Yet scientific thoroughness requires that their effects be tested by available methods against available data. If the null hypothesis relating war and disease is correct we still cannot accept it on faith. The list of "deaths according to cause" published in the World Health Statistics Annual by the World Health Organization includes "injury resulting from operations of war" with deaths from various standard diseases for different nations. These data can be analyzed through time-lagged correlation and regression statistics (cf. United Nations, 1975).¹²

¹²The only such attempt, to my knowledge, is Cattell and Gorsuch's (1965) isolation of an empirical factor which involved high and low loadings as follows:

<u>Low</u>	<u>High</u>
Homicide and War death rate	
% Population Catholics	
Syphilis death rate	% Population Protestant
Tuberculosis death rate	% Population Moslem
Proportion of births illegitimate	Divorce rate
Alcohol death rate	
Typhoid Fever death rate	

Further, there needs to be greater attention to case finding among both historical and contemporary decision-makers, with a view to broadening our knowledge about prevalence and incidence of particular diseases, and their relationship to subsequent peace and war.

Physical Environment

Physical Causes of Disease

Over time we have become conscious of the physical causes of well-being and disease. These include soil, water, climate, and nutrition. Various sub-disciplines have developed to deal with these matters. Thus geo-medicine deals with the "medical, health, and sanitary conditions of various geographic areas of the world" (Simmons, et. al., 1944, I:vii).

Physical Causes of War

Physical factors seem even further removed from peace and war than biological ones. It seems fantastic to think that wars, revolutions and other disturbances are produced by astrophysical forces, such as cosmic cataclysms (Velikovsky, 1955, 1950) or sunspots (cf. Eddy, 1977).

Nevertheless, some elements of the more proximate physical environment may be more closely related to peace and war. The connection was suggested by traditional geopolitical strategic thought which focused on physical location and boundaries--proximity to the global "heartland," ocean and mountain barriers--as important determinants of international relations.

Modern theory and research has not been willing to go much beyond this to consider additional elements like nutrition and climate.

Nutrition may have direct effects on peace and war. Drug and alcohol consumption may significantly affect attitudes and behavior.¹³ Low daily intake of total calories, or of protein may produce the same kind of vulnerability as chronic parasitic infestation. Relatively high proportions of sugars and starches in the diet, on the other hand, may contribute to wide fluctuations in energy levels, irritability, anxiety, and depression.

Nutrition may have different effects, over the short and long term, involving major political decision-makers, the general population, and the childhood development of future population cohorts. We need much more

¹³Our view of war is similar to contemporary perspectives on criminal behavior as sickness held by many sociologists, psychologists, and biologists. Nutrition may be an important accessory to crime. In some cases its contribution is judged to be so substantial that the individual is released from responsibility and culpability for his actions. In other cases the person may be hospitalized rather than jailed. See Jellinek (1960) for a parallel discussion of alcoholism.

data analysis linking peace and war to levels and changes of consumption among different population groups of alcohol, drugs, general intake of calories as well as proportions of starches, carbohydrates, sugars, fats; essential vitamins and minerals.

More research is also needed on climactic effects. Folk knowledge, which we tend to discount heavily, tells us that people in temperate zones tend to be more energetic, or that very high winds can have psychological effects. To round out our picture of the environment, we need more rigorous accounting for such variables as latitude, longitude, temperature, altitude, humidity, precipitation, and wind.

As with the biological environment, the null hypothesis may be correct, but it needs to be empirically examined and explicitly demonstrated.

Decision-Makers

In addition to the environment, explanations of peace and war must include decision-makers. The rational component of decision is concerned with the consequences of alternative policies or courses of action on the future environment. It centers choice around the most appropriate means to achieve desired ends like health or peace, or to avoid undesired ones like disease or war. We speak of rationalization when it appears that the past environment is the major determinant of present decisions, when it seems that people act, not for the reasons they adduce, but because of other forces acting upon them.

Rational Decision and Disease

We may not be acutely conscious of it, but decision-making has an important influence on disease. Epidemiology may suggest a black box model in which the micro-organisms are not conscious and in which the host almost mechanically applies available medical technique to combat them.

Nevertheless, individuals faced with the possibility of disease may choose to act in a variety of ways. They may suffer stoically, believing in the unavoidable force of destiny, the will of God, or the natural recuperative power of the life force or the human body. They may choose from a variety of available medical techniques in an attempt to prevent, ameliorate, or cure the disease. Some of these techniques may use disease itself, as in contemporary inoculations with live or dead natural biological agents, or their artificial surrogates.

Rational Decision and War

Traditional analysts have believed that rational decision is the primary determinant of peace and war, that the rational choices of individual decision-makers explain a significant part, most, or even all of war activity. This perspective is particularly strong in diplomatic and military history and science, which deals with the perceptions and calculations of statesmen and generals. Thus, Thucydides tells us that the

strong do as they will, while Clausewitz believes that war is the continuation of policy by other means.

From this perspective, the environment is a much less significant influence on war than we have suggested. Wars are not "caused," as we have proposed here, by the ecology of an interrelated system. Rather wars are "chosen" because of the subsequent beneficial effects they are likely to produce for those who wage them. Wars are a product of instrumental rationality, based on the calculation of "expected utility"--achieved by calculating the values of alternative proposed actions and the probabilities of their success, comparing them, and choosing the course of action with the highest projected benefit or lowest cost. Wars are undertaken in order to reach certain clearly defined ends. The benefits of wars are calculated, balanced against their costs, and found to be generally superior to them. When the costs outweigh the benefits, the actors stop fighting (cf. Larsen, 1973; S. Rosen, 1972; Kecskemeti, 1964). Modern diplomacy and intelligence supply up-to-the-minute information about all aspects of the environment. The technical tools of modern systems analysis, operations research, statistical decision theory, and mathematical game theory help contribute to the rational calculation of costs and benefits, means and ends, of belligerent activity. Modern military science supplies strategy and tactics appropriate for military activity under different circumstances. Economic, social, cultural, and psychological resources are orchestrated and applied where they will do the most good.

These rational elements exist, but should not be over-estimated. Wars are hardly ever "chosen" in the simple and straightforward manner the traditional view suggests. Formal accounts of rational decision making are often at variance with more informal reports. These informal accounts need not be accepted at face value. Yet, the popularity of breathless narratives which reconstruct the "true story" from "inside dope," or "kiss and tell" memoirs by participants themselves, clearly suggest the deficiencies of formal rational models of decision-making.

The rational calculation and comparison of expected utility, given the state of knowledge, is extremely difficult. We would not go so far as to identify free will simply as the error factor in the structural equations describing environmental dynamics. Nevertheless, the traditional view imputes to decision-makers qualities which they may not possess, a capability of rational processing which may be absent, particularly in the difficult conditions of wartime choice. The formal model of rationality underestimates the independent effects of the environment; ignorance of these environmental dynamics; disagreement and confusion about central values and disvalues, including peace and war; and the high degree of constraint, uncertainty and emotion which typically surround decisions to go to war.

The environment exerts an influence independent of the actions or beliefs of individual decision-makers. From this perspective, decision-makers may not be so much heroes as victims. War seems less like something decision-makers choose than something which somehow happens to them, and

which they do not really understand. Thus at the outbreak of the First World War, the ex-chancellor of Germany, Prince von Bülow, said to his successor, "How did it all happen?" "Ah, if only we knew," was the reply. According to Robert Kennedy's account (1969), this exchange had an important impact on President John Kennedy's thinking at the time of the Cuban missile crisis. The exchange of the German Chancellors had been reported in Barbara Tuchman's book, The Guns of August, which had made a great impression on the President. "I am not going to follow a course which will allow anyone to write a comparable book about this time, The Missiles of October," he said.

To some extent, President Kennedy was thinking wishfully. Over half a century has passed since the outbreak of the First World War. We have gained some additional understanding of the causes of war which has helped us to eliminate some conflicts. Yet our own country has been involved in international violence through the last 35 years--World War II, Korea, and Vietnam; crises in Europe (Berlin), Latin America (Cuba), and the Middle East. In addition is the less visible but on-going general military assistance to various nations in all parts of the world. Obviously statesmen's understanding of international violence does not yet enable them to avoid it entirely.

Statesmen do make decisions, but these are, to a certain extent, like the behavior of a person in the grip of a serious illness, epiphenomena reflecting the underlying environmental factors. The environment does not produce war by itself. It influences and limits political decision-makers. We may describe these environmental influences on decision-makers in colorful ways. We can say, with Hegel, that history, or destiny, works its way through individuals. Or we may see decision-makers, like the early British Fabian socialists, as puppets controlled by outside strings. Or we may envision humanity, as Einstein did, riding on a beam of light (Bronowski, 1973:247-256).

Decision-makers are people like the rest of us, and the environment also influences them in a more personal, and private way. A growing body of psycho-historical theory and research has helped illuminate how past environments, the setting of childhood or other learning experiences, exert a continuing presence in the decision-maker's memory and general attitude and relation to the world, and to violence and conflict.

Environmental forces are so complex that decision-makers may glimpse only their shadows. Thus one student of formal rationality in decisions for war states that "in my opinion, gain (or avoidance of loss) is the common reason for undertaking warfare." Yet he recognizes that not all, but only "some wars were undertaken for perfectly rational reasons." And that even in these cases "the people making the decisions may have miscalculated. Businessmen frequently make investments that turn out badly. This is not because they are not motivated by a desire for gain or because they are irrational, but simply that the problems are very difficult and it is easy to make a mistake. The problems of war and peace are equally difficult and mistakes are equally likely" (Tullock, 1974:87).

In order to make rational decisions the statesman should be clear about the identities and relative importance of major values, as well as the effect of war on those values. Yet, different groups and individuals in society have different priorities. War may be a good in itself or at least a lesser evil for "hawks." "Doves" have a much higher repugnance to it, no matter what the promised benefits. Further, the relationship between war and major values is not necessarily clear. To some, the failure to fight may seem to involve sacrifice of dearly held values, including liberty, equality, fraternity, welfare. For others, however, war may appear inconsistent with these desired goals.

Different types of decisions are taken under different kinds of conditions. Formal rationality seems likely to be approached most closely when there is a wide range of alternative options, good information, and plenty of time. The decision for war, however, typically tends to rank low on such measures. War decisions involve relatively high degrees of forced choice. The onset of war is often seen in the context of a restricted range of choice, rather than an expanded one. Statements of lack of choice often appear in explanations of war: "We did not want war," "we were forced to act," "we had no choice but to. . . ." While one's enemies appear free to do as they please, one's own side seems to operate in a much more necessary and closed context of decision. Thus leaders of major European states typically saw their own range of choice before World War I as relatively closed and less significant than the forces of necessity or the choices of their enemies. Finally, decisions to go to war are ones in which judgment is quite likely to be infused with emotion. Even though it may seem that confrontation with danger or death clears the mind wonderfully, the decision to go to war involves considerable confusion and stress. Information is inadequate, and time and tempers tend to be shorter than usual. Panic is both a threat and a possibility (cf. Holsti, 1972; Janis, 1972; Kennedy, 1969; North, et. al., 1963. See also Hallstrom, 1973).

Decisions do have an independent rational component. Whether we consider human beings as primary or intermediary hosts or agents of the disease, they must decide how best to defend themselves or to attack others. It may be that the decision for war, under certain conditions increases general well-being, or at least well-being for some of the decision-makers.

Nevertheless, the assumption of formal rational calculation as the primary determinant of war is no more justified than any other assumption without exhaustive empirical validation. We need to know more about the rational component of decisions for peace and war--value mixtures, anticipated consequences, subjective probabilities--and its relation and interaction with different environmental conditions.

Comprehensive Models

The systemic relationships between environment and decision-makers need to be elaborated in comprehensive models, which synthesize our knowledge of causes of war and which themselves can be tested as integrated wholes.

Sophisticated mathematical models of epidemiological process have existed for sometime. These specify the interaction between various dimensions of environment and host for different diseases (see Bartlett, 1960; Bailey, 1957. Cf. Newman, 1977, Nowakowska, 1973; Fleck and Ianni, 1958).

Similar models must be developed if we wish to advance our understanding of peace and war. Major theoretical work on the causes of peace and war has been at a very general level or has focused on the encyclopedic compilation and categorization of facts, hypotheses, or perspectives. (Cf. Alker, 1977; Nettleship, et. al., 1975; Blainey, 1973; Brodie, 1973; Alker and Bock, 1972; Deutsch and Senghaas, 1973; Alker and ~~and~~ 1972; Etzioni and Wenglinsky, 1970; Pruitt and Snyder, 1969; Wright, 1965; Waltz, 1959).

The evolution of more comprehensive theory depends on specification of a number of alternative models which include the inventory of relevant variables and link them through a complex network of causal relationships.

The models must be operationalized and quantitatively tested against experience in the real world to see how well they predict future events.

From such work, we should be able to specify a generally stable core of war behavior, the range of variation for different classes of wars, and patterns of combinations and discontinuous change (cf. Zeeman, 1977). Validating empirical research would be massively accelerated if presently closed or secret government data banks and files were opened to social scientists.

Prediction

Prediction should include prognoses of the natural ^{Cause} course of wars in general and of particular wars, as well as the specification of nations at high risk of war.

Description and explanation of diseases have provided a basis for general prediction of their normal course. Existing models allow the specification of groups and individuals at high risk (cf. National Cancer Institute and American Cancer Society, 1976). Different diagnostic tests have provided an empirical basis for making prognoses in individual cases; screening sample populations, identifying incipient symptoms, detecting at an early stage those who have the disease and differentiating them from those who do not.

The most abundant source of predictions for peace and war have usually been government officials and journalists (cf. Newcombe, et al., 1974). Advances in sophisticated description and explanation of war will help social scientists make better general natural course prognoses as well as forecasts in particular cases, specifying, for example, nations at high risk of war.

The Global Monitoring System would allow identification of and close attention to communities, regions, nations, and groups at high risk of violence. Thus high risk for social environmental factors might be deduced from low scores on aggregation, and high scores on polarization and militarization.¹⁴

Prescription

Prescription implies war prevention through intensive care in acute cases. It also includes peace maintenance, the general constructive management of the global environment through positive alteration of chronic risk factors.

Prescription and Disease

In the area of disease, "complete understanding of causal mechanisms is not prerequisite to development of effective measures for prevention and control." Because of "the multiplicity of causal chains. . . it is possible to interrupt the production of disease by cutting the chains at different points" (Mausner and Bahn, 1974:5-6, 35). Alternative modes of therapeutic intervention are possible, though professional consensus usually identifies treatments of choice.

In cases of acute disease there may be an emphasis on curative medical prescription. This may include manipulation of various dimensions of the environment: social quarantine; biological derivatives from other living systems, molds or fungi for example; physical remedies, including atomic radiation, chemical or mineral compounds.

Chronic disease,¹⁵ on the other hand, may imply preventive medicine more strongly: various social programs involving, for example, the installation of sanitary facilities or the reduction of pollution; biological remedies such as more exercise or the injection of agents to activate natural immune systems; physical programs to increase nutritional quantity or quality, heating or air conditioning facilities.

Finally, prescription may aim at the decision-maker by attempting to disseminate new information or using other incentives or constraints to increase motivation.

¹⁴Advances in predictive estimation techniques will also be helpful (see Efron and Morris, 1977).

¹⁵The profile of chronic disease includes: the absence of known agent, a multi-factorial etiology, a long latent period, indefinite onset, differential effect of factors on incidence and cause (Mausner and Bahn, 1974:Ch. 13).

Prescription and War

The science of peace and war should also develop more powerful prescriptive tools which will allow it to become a science not only in the pure, but also in the applied sense. Two major prescriptive tracks are war prevention and peace maintenance.

War Prevention

War prevention implies intensive care for acute cases--those which have already broken out or threaten to.

Unfortunately war, in its acute stage, now appears to be incurable. Once war has achieved a certain size, it seems to expand with its own logic. Faced with others who appear to act in a warlike way, it may seem that there is no choice except to kill or be killed, if even that. Nevertheless, efforts in a variety of different sectors may help limit the spread of violence, terminate it quickly, and lower the casualties. In threatening prewar situations modern techniques of crisis management may also be useful (cf. Young, 1977; Hermann, 1972).

Peace Maintenance

If we see war as a chronic disease, we may take a more preventive approach, looking not only to slow the direct spread of violence, but also to speed recovery from it and strengthen barriers against it.

Peace maintenance implies the long term constructive management of the global environment. We ought to have better chances of success at earlier and less severe points of malignancy to build a sub-structure of resistance to violence.

Alternative models of peace and war should suggest which risk factors are alterable and unalterable, as well as alternative policies for their manipulation. They should advise how much can be accomplished by changes in social, biological, and physical dimensions of the environment, and how much needs to be done by different sets of decision-makers to dampen forces and augment positive ones. Advances in dynamic programming and computer simulations will help us plot the interactions of many variables and actors.

Experimentalism

Epidemiology implies an experimental approach to peace and war. It also represents an experiment itself. Epidemiology is not the answer. Hopefully, it will have some marginal utility in addition to existing perspectives.

One of the major reasons that the study of disease has made greater progress than the study of war, as we noted above, has been its suitability to experiments. Such experiments have usually begun on a small scale, with animals or a few individuals. As they have proved successful they have expanded to human groups and finally entire populations. The results appear to have been good in terms of general health. Human beings have not conquered sickness or achieved immortality. Yet today individuals do not usually die of the diseases from which their ancestors perished. And they have at least twice their life expectancy--that is to say they have been awarded an "artificial" life as a bonus above and beyond their "natural" one (cf. Peterson, 1969:246). Some of the results for specific diseases have been spectacular.

The concept of eradication of a disease, i.e., total elimination of that disease worldwide, was considered visionary a few decades ago, but is now potentially attainable for at least two diseases. Under the leadership of the World Health Organization, major campaigns are now under way to eradicate smallpox and malaria (Mausner and Bahn, 1974:288).

Many specific illnesses still remain. Yet, even though there are still no available "cures" for them, we hope that one day effective remedies will be available.

We may hope for a parallel evolution of peace science. New knowledge may not eliminate war, or achieve perfect peace or tranquility. Yet it may eliminate many wars, and causes of wars, which have historically occurred and which take place today. In so doing it will also contribute to the extension and, we can hope, the improvement of human life.

An experimental approach may help us along this road. Such an approach suggests strategies for historical and contemporary analysis. We can analyze past policies through quasi-experimental statistical techniques (Caporaso and Roos, 1973. Cf. Etzioni, 1970).

Future policies can be designed as more authentic experiments, along the lines of contemporary evaluation research and impact analysis (cf. Glass, 1976; Bernstein, 1975; Struening and Gutentag, 1975. Cf. Hendricks, 1976). This involves clear definition of policies, projects, programs and plans; values to be achieved scaled by importance, and anticipated consequences. These policies may be implemented in selected control groups at different risk of war, and the results carefully monitored and compared with situations where other policies were followed.

The epidemiological perspective on peace and war must itself be viewed in such an experimental light. It represents an alternative to more traditional historical approaches and also to modern perspectives oriented around the physical sciences.

We have elaborated in some detail what kinds of action such an approach implies by way of description, alternative explanatory models; complication of those models by specification of key factors, and relations between them; testing against existing theory and data; prediction; and prescription.

Epidemiology does not necessarily provide the answer to peace and war. It does, however, give us an alternative perspective, which brings new insights and new questions. Like other metaphors and paradigms, the epidemiological perspective is an artifact, not absolutely good or bad, valid or invalid. It may be more or less useful in general or specific circumstances. Hopefully it will help us to improve the quality of choice and reduce violence--or at least not encourage it as forcefully as other approaches.

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